RESEARCH HIGHLIGHTS

STRUCTURAL BIOLOGY

Hitching a ride

Nature Struct. Mol. Biol. doi:10.1038/nsmb1212 (2007)

A glimpse into the molecular machinery of the flu virus suggests how it smuggles one of its key enzymes into the infected cell's nucleus, where the enzyme helps the virus to replicate.

Scientists are particularly interested in this enzyme, RNA polymerase, because it is a potential drug target and because mutations in it could help avian flu adapt to humans. Its structure has been hard to study because the enzyme is difficult to make in a suitable form.

Darren Hart and Stephen Cusack of the European Molecular Biology Laboratory in Grenoble, France, and their colleagues used a new method to identify a small, soluble fragment of one of the polymerase's subunits. They found that it has a grappling-hook-like structure and showed that the subunit slings this across a host protein, which then ferries it into the nucleus.

CLIMATE SCIENCE

Clouds on the horizon

Geophys. Res. Lett. **34,** L04701 (2007)

A trend in satellite data suggesting that Earth's cloud cover has decreased by 4% over the past 20 years is an artefact of the observations, say Amato Evan at the University of Wisconsin-Madison and his colleagues. This adds new uncertainty to the role that clouds have played in recent climate change.

The International Satellite Cloud Climatology Project collects data from different satellites to build global cloud maps. Satellites tend to perceive zones viewed obliquely as being more cloudy, because they are looking through a thicker swath of atmosphere. The launch of additional satellites during the project's lifetime has reduced this effect because each satellite now scans a smaller patch of sky. Evan's team says that this explains the apparent drop in cloudiness.

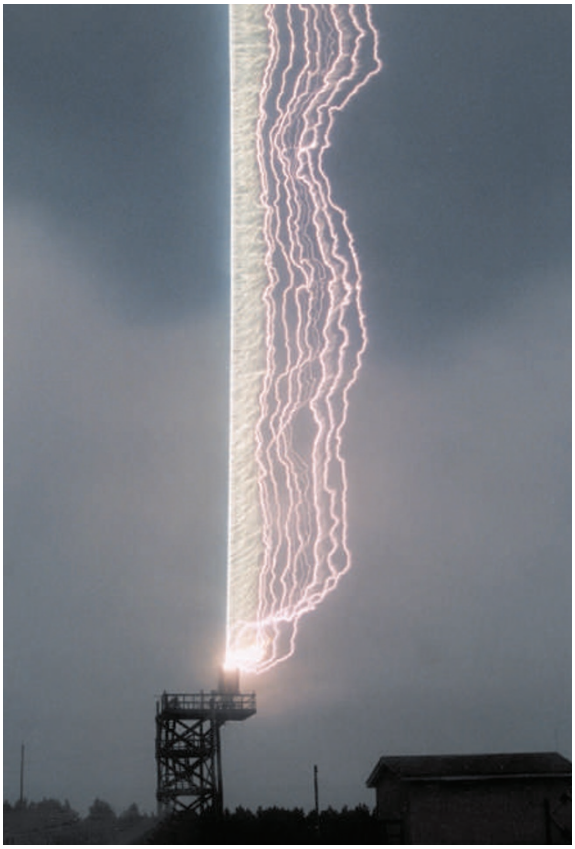
A flash of NO_x

Geophys. Res. Lett. **34,** L03816 (2007)

Nitrogen oxide production by lightning has been measured directly for the first time. The experiments were performed on lightning triggered by shooting a rocket trailing a copper wire towards a thunder cloud.

Lightning is a major source of nitrogen oxides (NO_x) in the atmosphere, and pinning down its contribution is important in assessing man-made levels of the pollutant gases.

Mahbubur Rahman of Uppsala University in Sweden and his colleagues diverted a portion of the triggered lightning through a sealed chamber on the ground. They found that the flash produced up to 3×10^{20} NO_x molecules per metre for every coulomb of charge it carried. This is roughly consistent with estimates based on data from aircraft flying through thunderstorms.



V. A. RAKOV

EVOLUTION

All right for snakes

Biol. Lett. doi:10.1098/rsbl.2007.0600 (2007)

A study of snail-eating snakes in southeast Asia has shown a remarkable feeding adaptation: many snakes of the subfamily Pareatinae have more teeth on the right side of their jaw than on the left, to match the fact that their snail prey tend to be coiled in a right-handed, or clockwise, way.

This observation was made by Masaki Hoso of Kyoto University, Japan, and his colleagues, who also confirmed the advantage it confers. In feeding experiments (pictured), one such snake, *Pareas iwasakii*, extracted and ate right-handed snails faster than left-handed ones. The diversity of left-handed snails in southeast Asia, which is higher than elsewhere in the world, may result from this evolutionary pressure.

ROYAL SOC.

FUEL CELLS

Hot chemistry

Anal. Chem. doi:10.1021/ac062189o (2007)

Researchers trying to understand the chemistry occurring inside solid-oxide fuel cells have a problem: the devices operate at temperatures that few chemical probes can tolerate. Infrared spectroscopy, for example, is thwarted by the brightness of thermal radiation emitted by a hot fuel cell.

Robert Walker of the University of Maryland, College Park, and his colleagues now show that it is possible to obtain real-time information using another technique, known as Raman spectroscopy. They tracked how carbon deposits grow and disappear from fuel-cell electrodes fed with butane or carbon monoxide, and identified intermediates formed during fuel-cell operation.

MATERIALS CHEMISTRY

Switchable shapes

Science **315,** 1116–1119 (2007)

Polymer sheets can be programmed to bend and wrinkle into prescribed structures, report Eran Sharon and his co-workers at

the Hebrew University of Jerusalem. They made flat discs of a soft gel that, when warmed gently, curved into domes, saddles and even sombrero shapes. Such switchable shape control in a soft material could have applications ranging from optics to biomedicine.

The sheets change shape because the gel — a web of crosslinked polymers — shrinks at temperatures above 33 °C by an amount determined by the local polymer density. When the density varies across the disc, the sheet buckles to relieve the pressure of uneven shrinkage. The researchers worked out what shrinkage patterns would produce the structures they wanted, then used an automated mixing system to produce gels with the right properties.

NEUROSCIENCE

Whiff of duality

Nature Neurosci. doi:10.1038/nn1856 (2007)

A faint odour can be captured more strongly by a powerful sniff, and researchers may have discovered why.

Minghong Ma from the University of Pennsylvania in Philadelphia and her colleagues have shown that up to half of mammalian olfactory sensory neurons respond to mechanical stimulation through air-pressure changes, as well as to specific smells.

The responses seem to share the same cellular pathway, with increased air pressure raising the firing rate of neurons that have been weakly stimulated by odorants. This mechanism may also help to synchronize the firing of neurons in the olfactory bulb with breathing.

CHEMICAL BIOLOGY

It's unnatural

Nature Methods doi:10.1038/nmeth1016 (2007)

Researchers in the United States have devised a reliable way of getting mammalian cells to integrate unnatural amino acids into their proteins. This will allow the design of proteins that act as biological probes containing, for example, amino acids that fluoresce.

During protein synthesis, enzymes called aminoacyl-tRNA synthetases hitch naturally occurring amino acids to transfer RNAs, which string them together in the order specified by the genetic code. Peter Schultz from the Scripps Research Institute in La Jolla, California, and his colleagues mutated a tRNA, and its corresponding aminoacyl-tRNA synthetase, so that the tRNA would insert an unnatural amino acid into a protein in response to a code normally reserved for a 'stop' signal. Similar methods have been successful in yeast and bacteria.

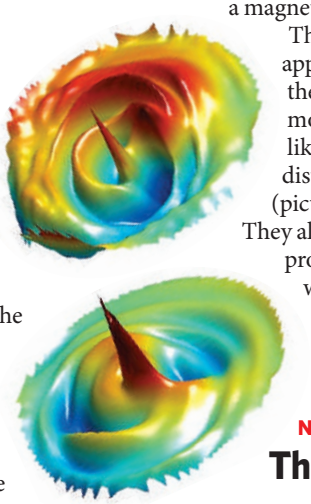
PHYSICS

Spinning up a whirl

Phys. Rev. Lett. **98,** 087205 (2007)

Simulations of a 'spin wave' generator make the idea that future computing devices might use these magnetic phenomena more plausible. Spin waves propagate as oscillations in the orientation of the magnetic moments of atoms in a magnetic medium. Harnessing their wave-like behaviour could lead to new paradigms for logic devices.

Sang-Koog Kim at Seoul National University in South Korea and his colleagues present a computer model of a 150-nanometre disc shooting spin waves into a magnetic wire.



A.M. PHYS. SOC.

They predict that briefly applying an external field to the disc when the magnetic moments are in a whirlpool-like arrangement will create disturbances in their orientation (pictured) that spill into the wire. They also model how spin waves propagate in the wire, and how wires with different magnetic properties could filter out specific frequencies of spin wave.

NANOTECHNOLOGY

Thin blue line

Nature Nanotechnol. doi:10.1038/nnano.2007.35 (2007)

A multitalented polymer nanowire has been unveiled by Gareth Redmond of the Tyndall National Institute in Cork, Ireland, and his co-workers. The nanowire has two properties that, together, turn it into a miniature laser: the polymer emits blue light, and the wire's cylindrical shape provides the 'optical cavity' required in lasers to amplify emission.

The researchers made the wires by melting a polymer called poly(9,9-dioctylfluorene) into a block of material riddled with holes. When that material was dissolved, the team was left with polymer wires that had diameters up to 400 nanometres and flat ends.

Such wires, which lase when light is shone on them, could form components in data-processing or sensing devices.

JOURNAL CLUB

Timothy M. Swager
Massachusetts Institute of Technology, Cambridge, USA

A chemist predicts a bright future for sensors based on carbon nanotubes.

I am struck by the parallels between the development of polymer-based chemical sensors and those made from carbon nanotubes.

About ten years ago, I started to develop sensors from conjugated organic polymers, which took advantage of the materials' optical properties, rather than the electrical properties that had been exploited in devices until that time. This work led to fluorescent sensors, which are now being used in Iraq to detect explosives.

As with polymers, early work on nanotube sensors focused on detecting changes in a tube's electrical conduction when it binds to a molecule of interest. But electrical responses are sensitive to stray electric fields, which create interference in the signal.

Now, researchers working with nanotubes are also moving towards optical methods. A demonstration of a biosensor for glucose (P. W. Barone and M. S. Strano *Angew. Chem. Int. Edn* **45,** 8138–8141; 2006) sets the stage.

To make the sensor, the team first attached glucose groups to nanotubes. They then mixed these nanotubes with a large molecule, known as concanavalin A, which can bind to four glucose molecules at once. The glucose-decked nanotubes end up caught in clumps around the concanavalin A, which attenuates their emission. This system is sensitive to glucose because any glucose in solution loosens the nanotube clusters, and so boosts fluorescence.

A significant advantage of nanotubes is that they emit near infrared light, a longer wavelength than that accessible with polymers. And it just happens that human tissue is almost transparent in this spectral region. As a result, sensors based on these materials might be used for *in vivo* clinical diagnostics.